CPG 2-1A1
June 1973

DCPA ATTACK ENVIRONMENT MANUAL

CHAPTER 1

INTRODUCTION TO NUCLEAR EMERGENCY OPERATIONS

DEFENSE CIVIL PREPAREDNESS AGENCY
DEPARTMENT OF DEFENSE

JUNE 1973

DCPA ATTACK ENVIRONMENT MANUAL

WHAT THE EMERGENCY PLANNER NEEDS TO KNOW ABOUT THE NATURE OF NUCLEAR WAR

No one has gone through a nuclear war. This means there aren't any natural experts. But civil defense officials are in the business of preparing against the possibility of nuclear war. Intelligent preparations should be based on a good understanding of the operating conditions that may occur in a war that has never occurred. Lacking such understanding, emergency operating plans probably won't make much sense if they have to be used.

This manual has been prepared to help the emergency planner understand what the next war may be like. It contains information gathered from two decades of study of the effects of nuclear weapons and the feasibility of civil defense actions, numerous operational studies and exercises, nuclear test experience, and limited experience in wartime and peacetime disasters that approximate some of the operating situations that may be experienced in a nuclear attack. In short, it summarizes what the Defense Civil Preparedness Agency now knows about the nuclear attack environment as it may affect operational readiness at the local level.

Stan #79581

RR# 1352

1973

Ch. 1

2170667

X

LIST OF CHAPTER TITLES

PREFACE TO CHAPTER 1

This introduction to nuclear emergency operations is aimed at the reader who has no special knowledge of the subject. It does not assume knowledge of the material in subsequent chapters of the Manual. However, material in this chapter is referred to in subsequent chapters.

Information is presented in the form of "panels" each consisting of a page of text and an associated sketch, photograph, chart or other visual image. Each panel covers a topic. This preface is like a panel with the list of topics in Chapter 1 shown opposite. If the graphic portion is converted into slides or vugraphs, the chapter or any part can be used in an illustrated lecture or briefing, should that be desired.

The ordering of topics begins with two introductory panels, followed by four panels on current enemy capabilities. There are six panels on direct effects, followed by two on fallout. The next six panels discuss operating contingencies, leading to the nine Basic Operating Situations. Three subsequent panels elaborate the relationship among the contingencies. Finally, two panels emphasize the need for coordination of emergency actions, leading to the concept of operations under nuclear attack. There is a list of suggested additional reading for those who are interested in further information on the general subject.

CONTENTS OF CHAPTER 1

"INTRODUCTION TO NUCLEAR EMERGENCY OPERATIONS"

CIVIL DEFENSE OPERATIONS

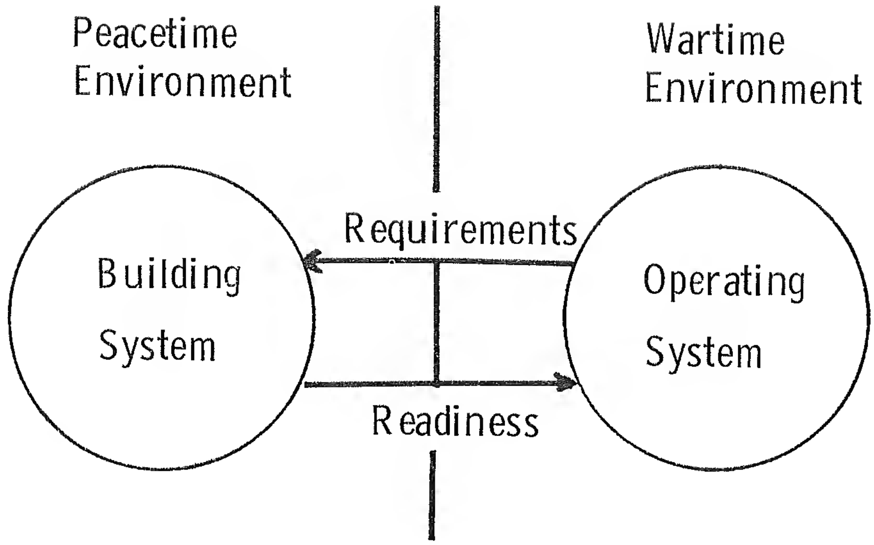
In the Federal Civil Defense Act, Congress stated, "It is the policy and intent of Congress to provide a system of civil defense for the protection of life and property in the United States from attack." Additionally, "The term 'civil defense' means all those activities and measures designed or undertaken (1) to minimize the effects on the civilian population caused or which would be caused by an attack upon the United States, (2) to deal with the immediate emergency conditions which would be created by any such attack, and (3) to effectuate emergency repairs to, or the emergency restoration of vital utilities and facilities destroyed or damaged by any such attack."

Civil defense operations are the activities and measures undertaken in event of attack for the purposes defined above. They will be undertaken in a wartime environment by the civil defense operating system, as indicated by the upper illustration.

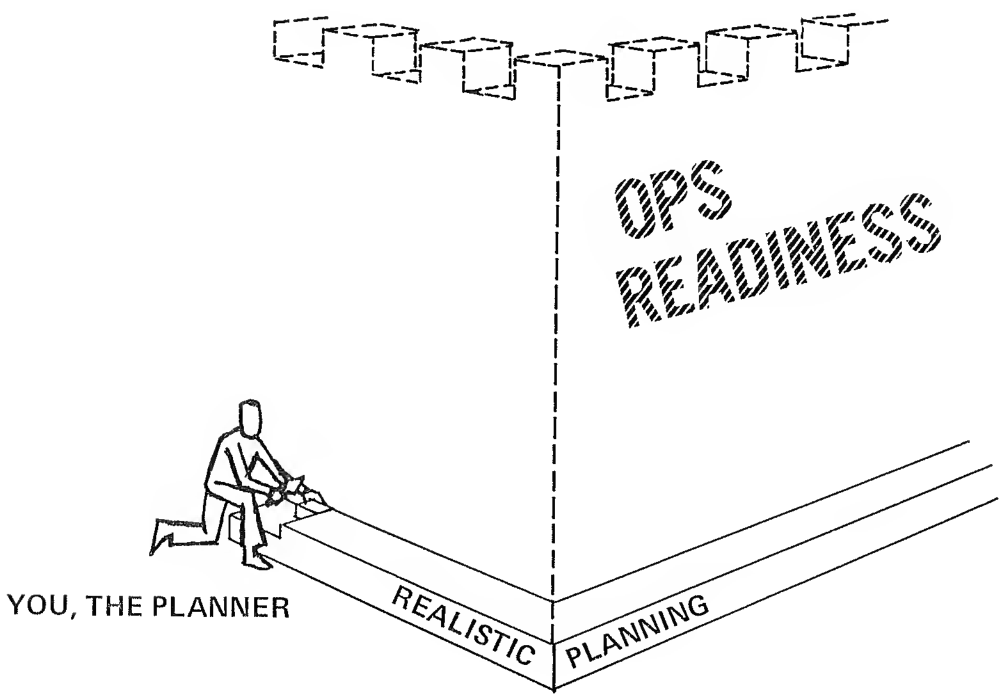
Only by a careful study of the needed civil defense operations and the attack environment that demands and constrains them can one understand the requirements for effective civil defense operations. This manual is intended to aid in this understanding.

To the extent that the operating requirements can be met, a locality is operationally ready. Building local operational readiness is the basic purpose of peacetime civil defense. Realistic operational planning is the foundation of operational readiness. Planning is the process by which the existing capabilities and resources of a community or area are organized in advance so that coordinated wartime operations are possible. Good planning also forms the basis for the development of additional capabilities needed to fulfill unmet requirements so as to improve local operational readiness.

Many of the civil defense operations needed to save lives and property in event of attack are also needed in peacetime emergencies. Therefore, civil defense operational readiness can serve both wartime and peacetime purposes. However, preparedness for peacetime contingencies does not automatically ensure readiness for attack contingencies. The ways in which wartime operational requirements are expected to differ from peacetime emergency experience will be emphasized in this manual where appropriate.



TWO CIVIL DEFENSE SYSTEMS



PANEL 1

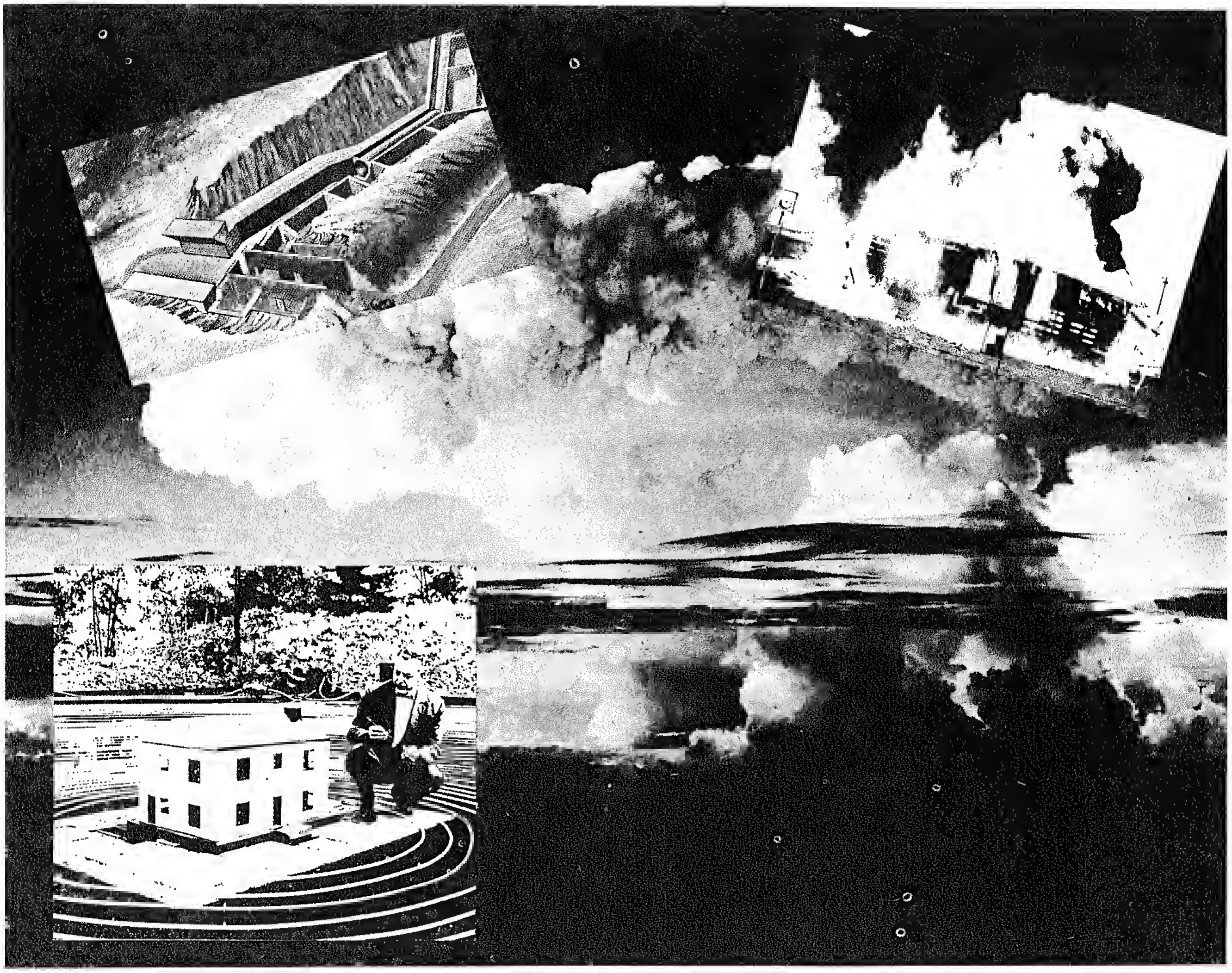
THE BASIS FOR OPERATIONAL PLANNING

Neither national defense policy nor local emergency operating plans for protecting the population against a nuclear attack can be based on experience. The expected effectiveness of any civil defense program or emergency action can be evaluated in a believable way only through simulation—hypothesizing various attack and defense combinations, and evaluating the consequences. Hopefully, by this means, meaningful insights can be developed as a substitute for the hard facts that do not exist from actual experience.

It is from such studies that the essential planning premises are developed. The extent of areas that probably would experience direct effects and severe fallout, the protection required, and probable shelter stay times are examples. The realistic planning of emergency operations under nuclear attack conditions places the most demanding requirement on the state of knowledge. Under what conditions will people survive blast and fire effects in American buildings? How fast will fires develop and spread? How much radiation exposure can an emergency team receive without serious permanent injury or degradation of performance? Questions such as these are answered only partly or not at all by analysis of the Japanese experience at Hiroshima and Nagasaki in World War II and the data from the nuclear weapons testing program of the 1950s. To fill in the most important voids in the information needed for planning and training has been the most important task of DCPA research during the past decade.

Illustrations of the experimental techniques used to provide a basis for nuclear emergency operations are those shown here. At upper left is the blast tunnel facility (see Chapter 2). At upper right is an instrumented building fire (see Chapter 3). At lower left is a fallout shielding experiment using a scale model (see Chapter 6).

The information in this manual depends heavily on the research base that has been built during the 26 years since the advent of nuclear weapons. Wherever appropriate, the basis for the facts presented will be described. But, first, in this Chapter, we present the "big picture," without which the attack environment information would not be useful.



PANEL 2

ENEMY CAPABILITIES

The probable nature of nuclear attack and its consequences are related to enemy capabilities. The Soviet Union is the primary potential adversary with the capability to inflict major damage and loss of life in the U.S. There are three general measures customarily used in summarizing the overall strategic offensive balance between the U.S. and the Soviet Union. These are numbers of delivery vehicles, numbers of warheads, and megatons of explosive yield. No one of these measures is significant alone, and all must be considered together with other factors such as reliability, accuracy, and range.

The tables on the opposite page indicate the comparative situation in mid-1972. Both sides have about 2200 intercontinental delivery vehicles (ICBM launchers, submarine launch tubes and long-range bombers), the Soviets somewhat more than the U.S. The U.S. has over twice as many weapons, since many of our ballistic missiles have been modified to carry multiple warheads. At the same time, substituting multiple small-yield weapons for single large weapons has resulted in a sharp decline in U.S. megatonnage. Soviet ballistic missiles have considerably greater "throw weight" or warhead capacity than U.S. ballistic missiles. Therefore, the estimated 2500 Soviet weapons constitute a much greater megatonnage than that represented by the more numerous warheads of the U.S.

Note from the table that most of the Soviet delivery capability is represented by ballistic missiles, both ICBMs and submarine-launched missiles.

STRATEGIC FORCE STRENGTHS

Mid-1972*

	USSR	USA
ICBM's	1550	1054
SLBM's	580	656
Bombers	140	531
Total Delivery Vehicles	2270	2241
Total Weapons	2500	5700

*p. 40 of Sec Def Statement of Feb 15, 1972

SIZE OF WEAPONS

Most of the Soviet attack capability would be delivered by ballistic missiles. The largest of these, the SS-9, could carry a single warhead with a yield of 25 megatons. There is a possibility that the Soviet Union may be in the process of fitting multiple warheads to its missiles, just as the U.S. is doing. The SS-9 has been tested with three warheads, each capable of a yield of 5 megatons. The majority of Soviet missiles have warheads with a yield of considerably less than 5 megatons.

Civil defense planners should be aware that there has been and likely will continue to be a trend toward larger numbers of smaller-yield nuclear weapons. The implications of this trend are:

(1) The larger number of warheads suggests more localities may experience the direct effects of nuclear weapons (blast, fire, and initial nuclear radiation) than if fewer large weapons existed.

(2) Some attack effects, such as initial nuclear radiation, become more important to civil defense planning if small-yield weapons are used (see Chapter 5 for more details).

(3) The overall fallout threat decreases when multiple warheads are used on missiles. Note, for example, that the Soviet SS-9 with 3 warheads carries only 15 megatons total yield as opposed to 25 megatons in the single-warhead version. If larger numbers of warheads were placed on the SS-9, the total yield would be even smaller. Also, as weapon size is reduced, the distances to which fallout is carried by the winds are reduced (see Chapter 6 for more details).

SOVIET MISSILES*

	SS-7	SS-8	SS-9	SS-11	SS-13
First Deployed	1961	1963	1965	1965	1967
Warhead Yield	5 MT	5 MT	20-25 MT	1-2 MT	1 MT
Estimated Number	220		~280	over 900	60

Soviet submarine-launched missiles are similar to the SS-13.

---

*As estimated in <u>The Military Balance, 1971-1972</u>, The Institute for Strategic Studies, London.

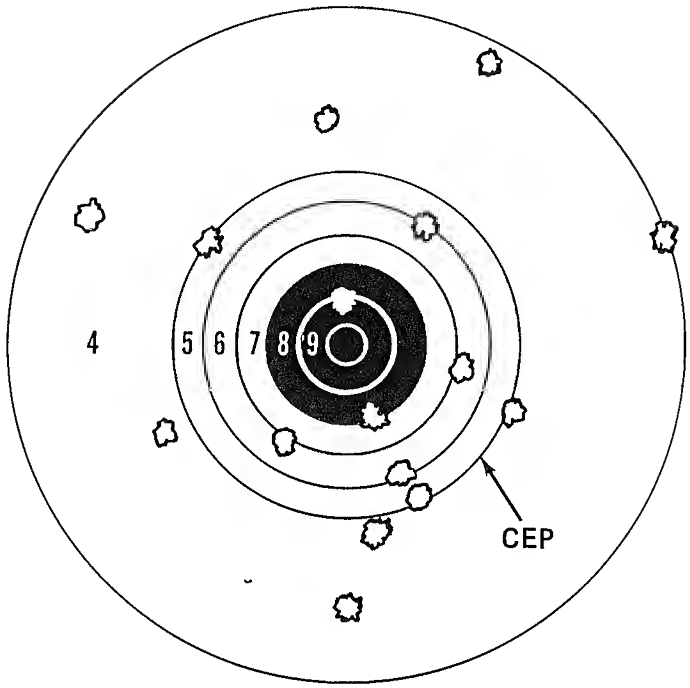
ACCURACY OF WEAPONS

How closely a missile or bomb can be delivered to an aiming point is measured by the CEP (circular error probable) of the weapon system. If a large number of weapons were to be aimed at a single aiming point, the CEP is the radius of the circle that includes half of the resulting actual "ground zeros" or hit-points. In other words, half of the ground zeros would be closer than the CEP and half would be further away, as shown in the illustration. A single weapon, then, has a 50-50 chance of hitting within the CEP.

Modern strategic weapon systems have a reasonably high degree of accuracy. A CEP of one-quarter to one-half mile is a common assumption in unclassified discussions of this subject. Since cities are fairly large, weapon accuracy is not an important factor in civil defense planning, although the planner should recognize that, in a large attack, a few weapons will be widely off the mark.

25- FT. TARGET

For All Air and CO   Pellet Rifles



In this target, the ring between 4 and 5 turns out to be the CEP circle because half the shots are inside the circle and half are outside.

PANEL 5

RELIABILITY OF WEAPONS

Most of the nuclear weapons that might be used to attack this country would be delivered by ballistic missiles, either land-based (ICBM) or sea-based (SLBM). These missiles are of recent development and have never been used in war. Since no mechanical contrivance works perfectly every time, reliability is an important factor both in planning an attack and in carrying it out. Estimates of reliability are developed in test firings and other operational checks. What the U.S. and U.S.S.R. believe to be the reliability of their own and the other's missiles is a closely-kept secret, but the general range has been described in Congressional testimony.

There are various ways that a missile may fail to achieve its programed objective. It may be in process of a technical modification or scheduled maintenance at the time of need. It may not be "ready" to be launched because of some malfunction that prevents a complete countdown. It may malfunction in the launch process. Finally, it may malfunction in flight. These various problems are multiplicative, so that even when great efforts are made to reduce the probability of failure at each stage, the combination of probabilities may result in limited overall system reliability. The table shows an example calculation, assuming that the probability of failure is only one in ten at each stage. Therefore, while the reliability of the missile force of the Soviet Union will never be known until they are used in an attack, that reliability could be as low as 0.5 and is unlikely to be as high as 0.9.

The implication for civil defense planning is not limited to the recognition that only part of the Soviet capability described previously can be expected to be delivered on U.S. targets. It also implies that no one can be certain that destruction of a particular target will actually take place. No part of a city can be "written off." Emergency planning should consider all reasonable contingencies. An example to illustrate this is given in the following pages.

MISSILE RELIABILITY*

Degradation Factor	Assumed Reliability
Missile Availability	0.9
Missile Readiness	x 0.9
Launch Reliability	x 0.9
In-flight Reliability	x 0.9
Overall Reliability	0.66

Under these assumptions, only 2/3 of the missile force would arrive on target. Of the missiles available and targeted, only about 3/4 would arrive.

*As estimated by Daniel J. Fink, former Deputy Director of Defense Research and Engineering in Science and Technology, October 1968.

DIRECT EFFECTS OF A 5-MT WEAPON

The energy released by a nuclear detonation alters the environment in a variety of ways. In the immediate region of the detonation, the main effects are due to the blast wave and the thermal pulse or heat flash. The blast wave can destroy or damage buildings, spread debris, and overturn trees. The thermal pulse can ignite exposed thin fuels, causing many sustained fires. These are the main **direct effects** of the detonation. The general reach of these effects for a 5-MT surface burst is shown in the illustration. The additional reach of an air burst of the same size is given at the bottom of the illustration.

Although people in the open can be burned by the thermal pulse and crushed by the pressure in the blast wave, if it is quite strong, most of the deaths and injuries in cities will result from people being thrown about or struck by missiles formed by the destruction of buildings, trees, and other objects. The overall survivability of people in ordinary structures is also shown in the illustration.

The strength of the blast wave is measured in pounds per square inch overpressure (psi) (see Chapter 2 for details). Note that damage of some significance extends to the region of 1 psi. The region where fires would be ignited as a result of the thermal pulse is well within the damaged area and mainly within the region covered by at least 2 psi overpressure. (See Chapter 3 for more information.)

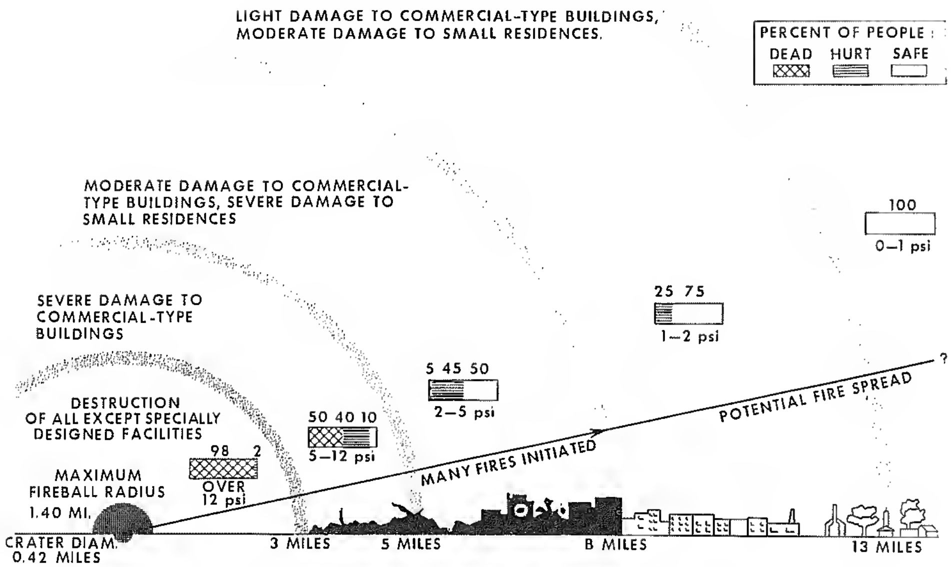
The implications for operational planning where direct effects may occur are:

(1) There will be many survivors in the damaged area, even if no special shelters are provided.

(2) The main firefighting and rescue needs are in the damaged area where debris may bar movement of wheeled vehicles and where water pressure may be lost because of broken connections.

Additional direct effects not shown are initial nuclear radiation and the electromagnetic pulse (EMP). These effects are not important in surface-burst weapons in the megaton yield range. The conditions under which they are important are discussed in Chapters 4 and 5.

DIRECT EFFECTS OF 5 MT. BLAST (SURFACE BURST)



IF BURST IS ELEVATED TO ALTITUDE MAXIMIZING THE REACH OF BLAST DAMAGE, MODERATE DAMAGE FROM BLAST AND INITIAL FIRES ON A CLEAR DAY ARE EXTENDED FROM B MILES TO 13 MILES.

PANEL 7

DIRECT EFFECTS OF OTHER YIELDS

Shown here are the blast and fire consequences of a 1-megaton and a 25-megaton detonation. This covers the yield range of current Soviet missile warheads.

Note that the range of "moderate damage and initial fires on a clear day" changes from 5 miles to 14 miles, an increase by a factor of about 3, for a yield increase of 25 times. This reflects the fact that, for practical purposes, the reach of blast and fire effects vary as the cube root of the weapon yield. (The cube root of 25 is 2.92.) In other words, for the range of direct effects to increase by a factor of 10, the yield must increase a thousand-fold. And that is what happened when "H-bombs" in the megaton-yield range replaced the "A-bombs" having an explosive power in the kiloton-yield range.

Note that an "air burst" at the appropriate altitude would expand the diameter of the damaged area by about 50 percent. These increased effects would be purchased at the price of elimination of the fallout hazard and the reduction of danger from high overpressures. Indeed, a detonation high enough in the air to maximize the reach of moderate damage (2 psi) would produce less than 15 psi at ground zero, leaving many survivors in ordinary buildings, just as there were in the attacks on Hiroshima and Nagasaki.

The areas of moderate damage and fire ignitions are large in any event, ranging from nearly 80 square miles for a 1-MT surface burst to about 625 square miles for a 25-MT surface burst. The average U.S. city of 100,000 has an area of about 25 square miles. Thus, only the very large cities would be of such size as to require multiple weapons or air bursts for widespread damage.

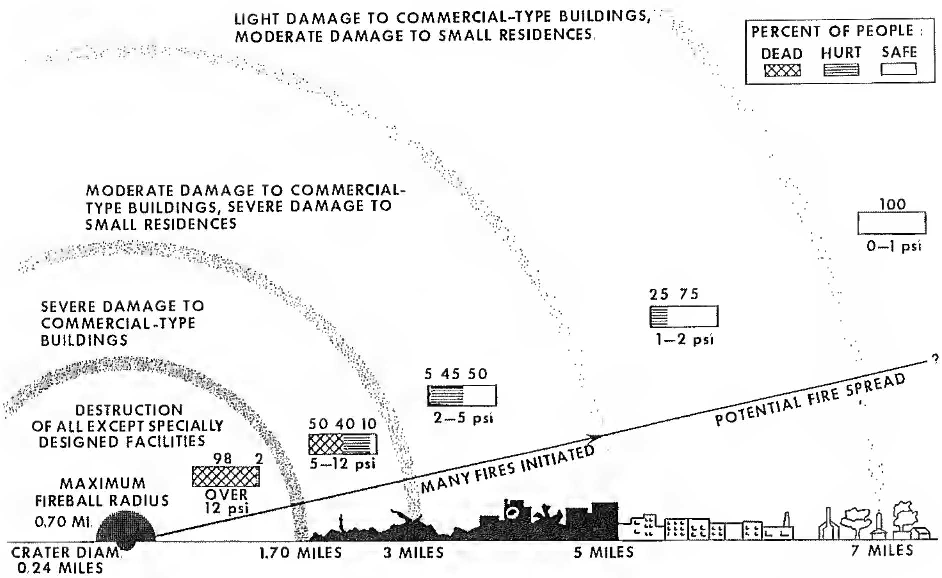
The implications for local emergency planning in metropolitan areas are:

(1) A community should be regarded as being "involved" in a situation of large extent if direct effects are experienced, rather than the reverse—an area of damage within the community's boundaries.

(2) There is a high probability that neighboring and nearby communities will experience similar damage as that in your community.

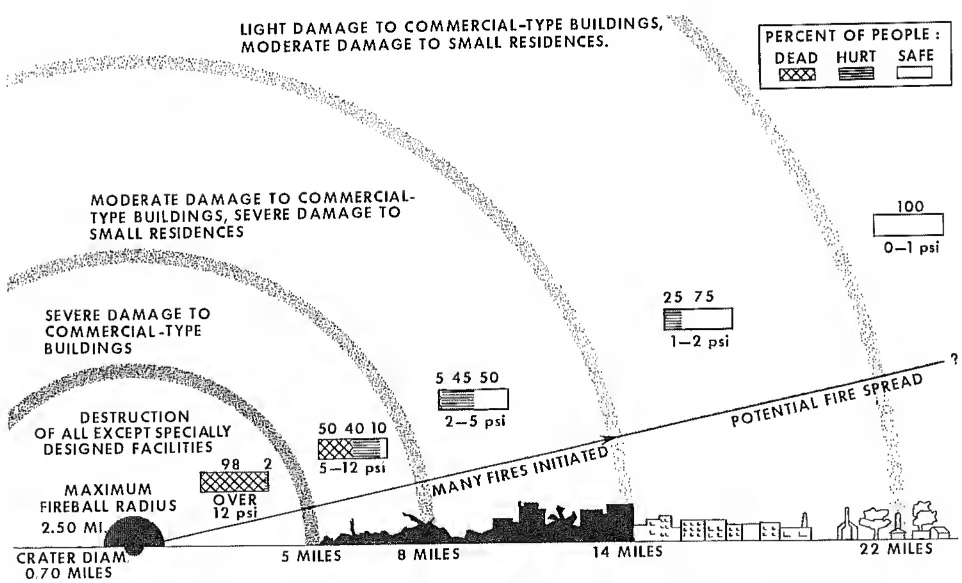
(3) A concerted effort to reduce the resulting threats to life and property by all the communities in the metropolitan area (and beyond) will be needed.

DIRECT EFFECTS OF 1 MT. BLAST (SURFACE BURST)



IF BURST IS ELEVATED TO ALTITUDE MAXIMIZING THE REACH OF BLAST DAMAGE, MODERATE DAMAGE FROM BLAST AND INITIAL FIRES ON A CLEAR DAY ARE EXTENDED FROM 5 MILES TO 8 MILES.

DIRECT EFFECTS OF 25 MT. BLAST (SURFACE BURST)



IF BURST IS ELEVATED TO ALTITUDE MAXIMIZING THE REACH OF BLAST DAMAGE, MODERATE DAMAGE FROM BLAST AND INITIAL FIRES ON A CLEAR DAY ARE EXTENDED FROM 14 MILES TO 22 MILES.

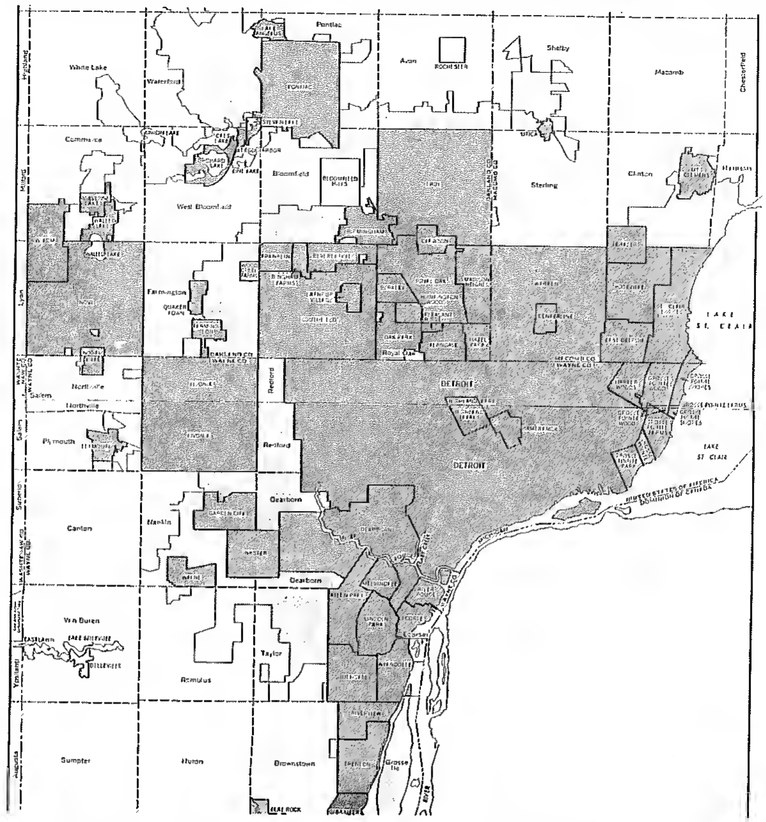
PANEL 8

AN EXAMPLE CITY ATTACK

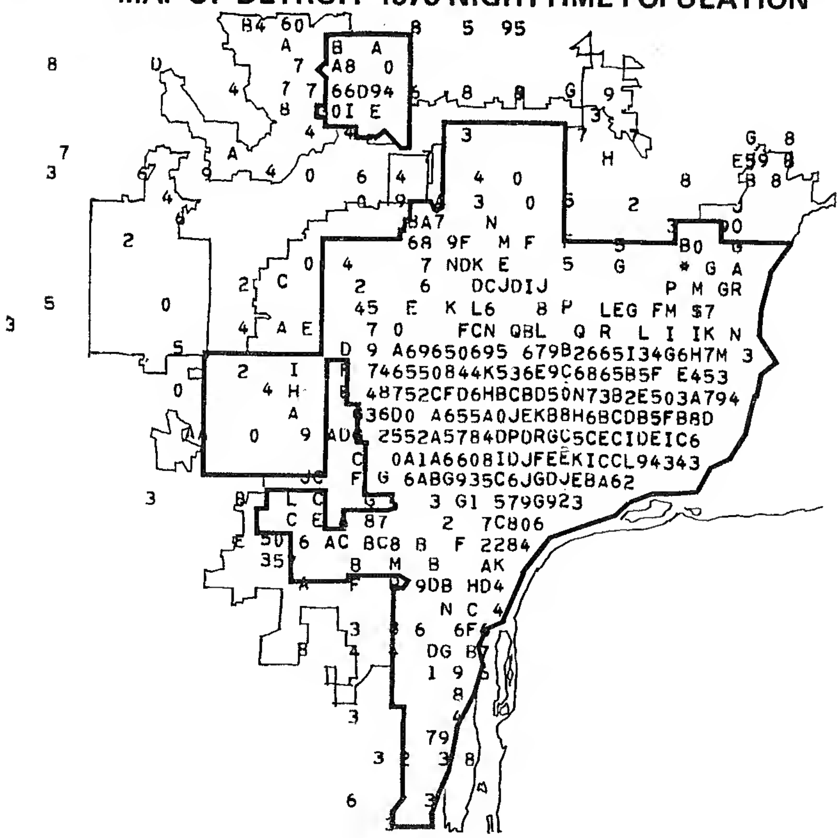
In the next few pages, we will present a picture of what might happen to the population of a city directly attacked by nuclear weapons. The example city is the Detroit metropolitan area. A census map of the Detroit area is shown in the upper figure. Below it is a computer map of the same area, showing the projected night-time population distribution in 1975.

Each number (and letter) in the computer map represents the number of people in "squares" that are 1 mile in the north-south direction and six-tenths of a mile in the east-west direction. The number 1 represents 1000 people or, more specifically, a population count between 500 and 1499 persons. The numbers 2, 3, etc., represent populations of 2000, 3000, etc., within the six-tenths of a square mile occupied by the number. The number 0 represents 10,000 people; the letter A represents 11,000; the letter B, 12,000; etc. Where a blank occurs, there are less than 500 people resident in the location.

CENSUS BUREAU MAP OF DETROIT URBANIZED AREA



MAP OF DETROIT 1975 NIGHTTIME POPULATION



PANEL 9

SURVIVORS FROM TWO 5-MT WEAPONS

Suppose 5-MT weapons were aimed to detonate where they would kill the most people. The weapon accuracy (CEP) is assumed to be one-half mile, and the missile reliability is assumed to be 0.75. All detonations are surface bursts. The population is assumed to be at home in single-family residences, townhouses, apartment houses, and the like.

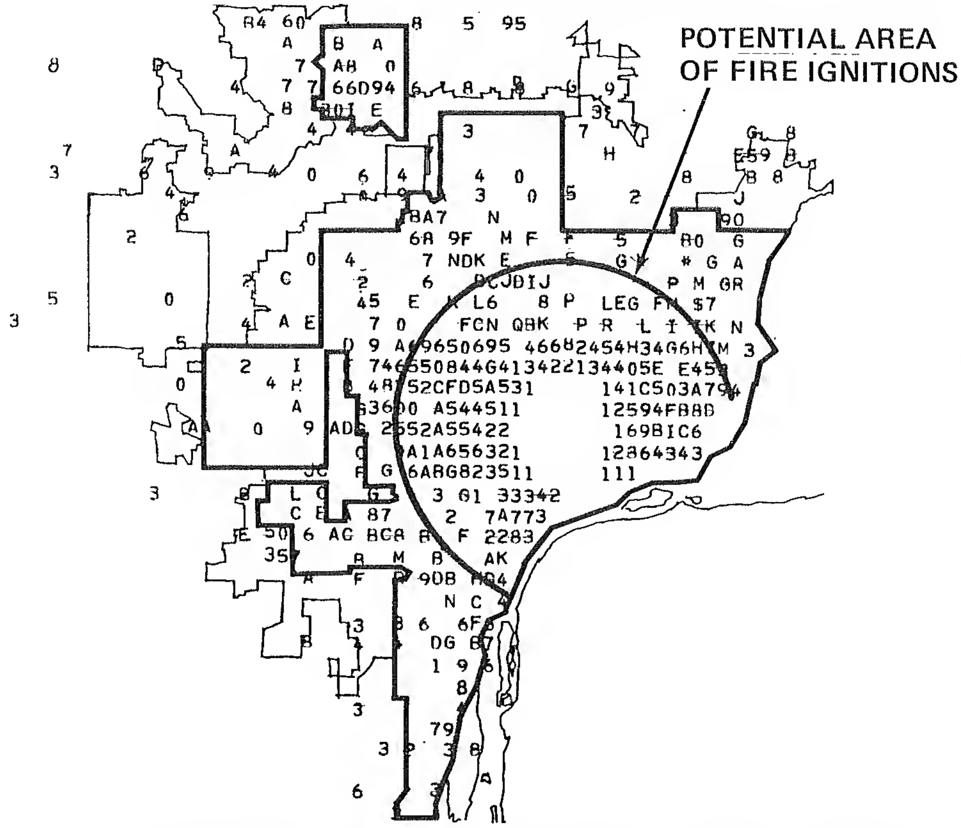
The upper map shows the survivors from a weapon aimed at the most densely populated area. A "hole" of about 3 miles radius has been created in the population map and the neighboring numbers of survivors are quite small. But overall, nearly 82 percent of the population survive the blast effects of this detonation.

The lower map shows the survivors from the detonation of two weapons. Two holes are evident and the total survivors have been reduced to less than 70 percent.

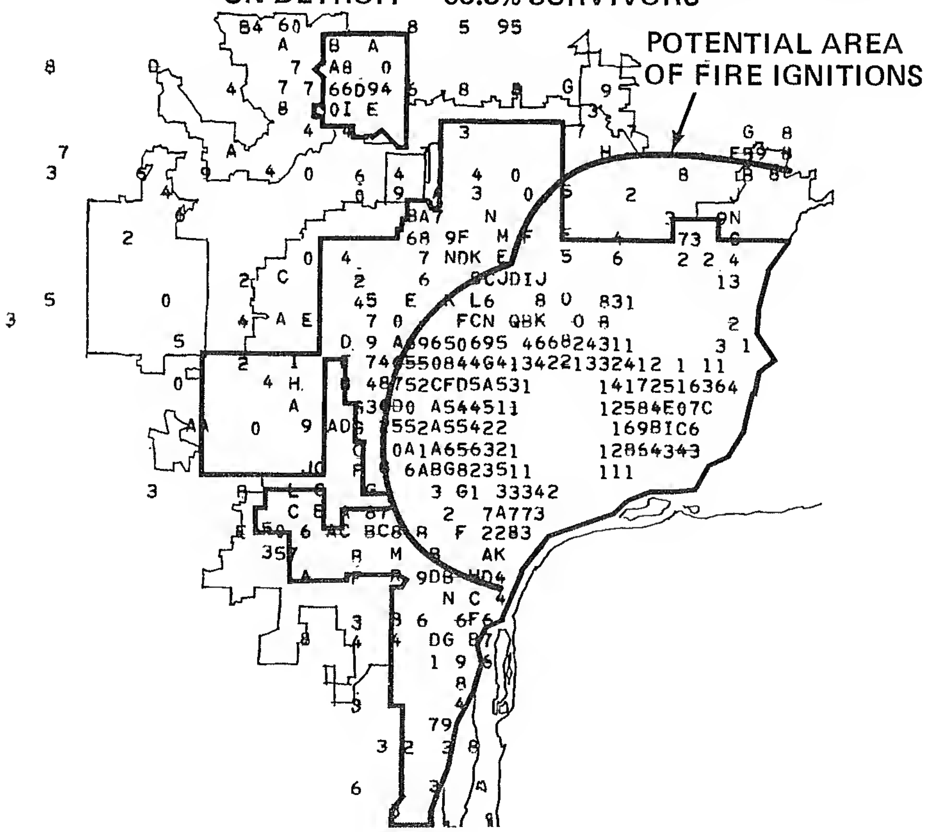
In either case, there are great numbers of survivors in the Detroit area. Civil defense emergency operations would be of great importance. Large numbers of these survivors would be injured and many trapped in wreckage. Although most of the dead are within a few miles of the detonations, fires ignited by the heat flash could be expected out to 8 miles. There would be much debris in this same area and then there would also be fallout. Civil defense operations would be important—and difficult.

Regardless, what these charts show is that, despite the destructiveness of weapons of this size, the city and its people are not obliterated. It is not a case of one bomb—one city (unless the city is quite small). Emergency operations readiness can pay off, even in target areas.

SURVIVORS FROM SAMPLE MONTE CARLO RUN FOR A SINGLE 5 MT WEAPON ON DETROIT – 81.5% SURVIVORS



SURVIVORS FROM SAMPLE MONTE CARLO RUN FOR TWO 5 MT WEAPONS ON DETROIT – 68.3% SURVIVORS



PANEL 10

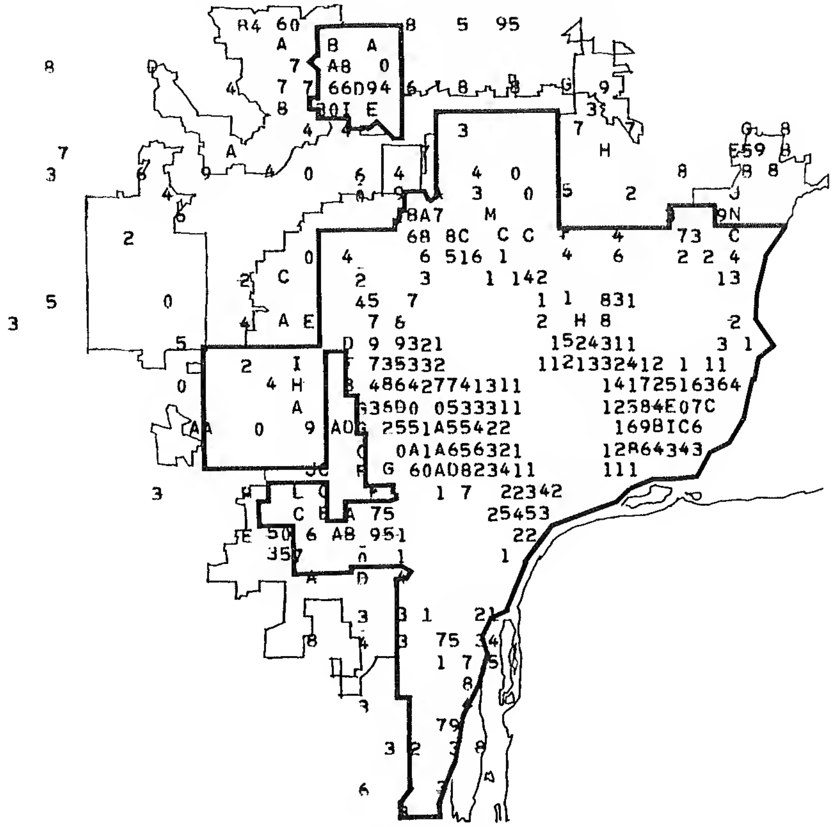
SURVIVORS FROM LARGER ATTACKS

Suppose a much larger attack were made on the Detroit urban area. The upper figure shows the result of five 5-MT weapons aimed at Detroit. Almost half of the population of the metropolitan area survive the blast effects of these weapons.

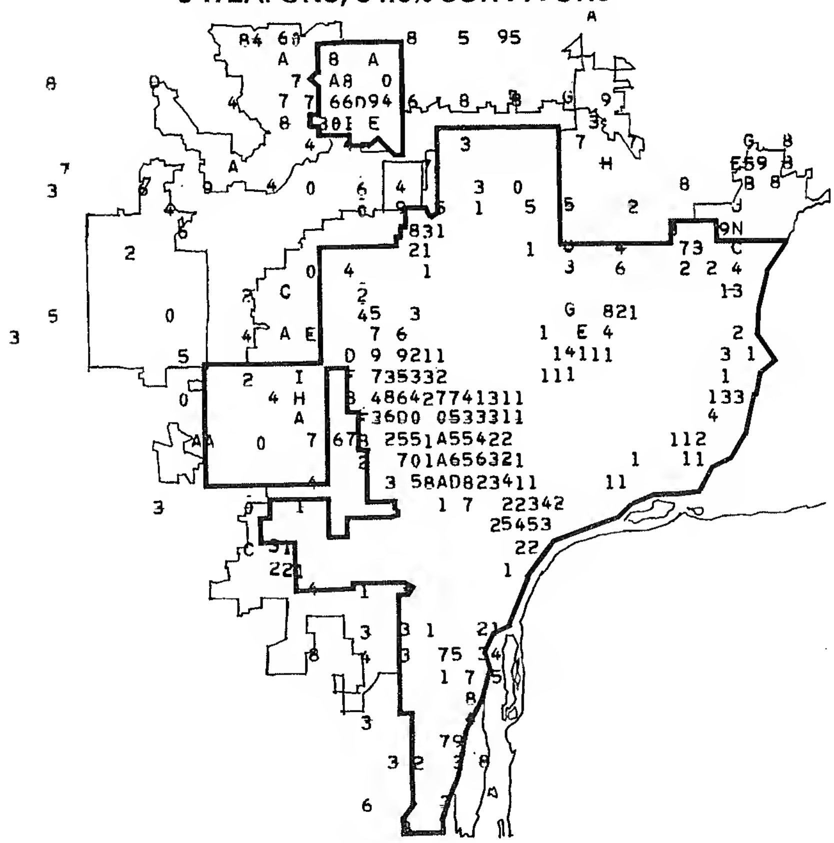
A comparison of this map with the earlier map of the night-time population will disclose only 4 "holes" in the population map. One of the weapons failed to arrive because the missiles are assumed only 75 percent reliable. In effect, the computer draws a number at random from 1 to 100. If the number drawn is 75 or less, the weapon is delivered. If greater than 75, it "malfunctions." In this particular case, weapon number 4 failed to arrive.

The lower figure shows the result for nine aimed weapons. About one-third of the population survive, partly because two weapons fail to arrive. Note the major "island" of survivors in a portion of downtown Detroit.

SURVIVORS FROM SAMPLE MONTE CARLO RUN FOR FIVE 5 MT WEAPONS ON DETROIT – 48.8 SURVIVORS



9 WEAPONS, 34.6% SURVIVORS



PANEL 11

SURVIVORS FROM A VERY LARGE ATTACK

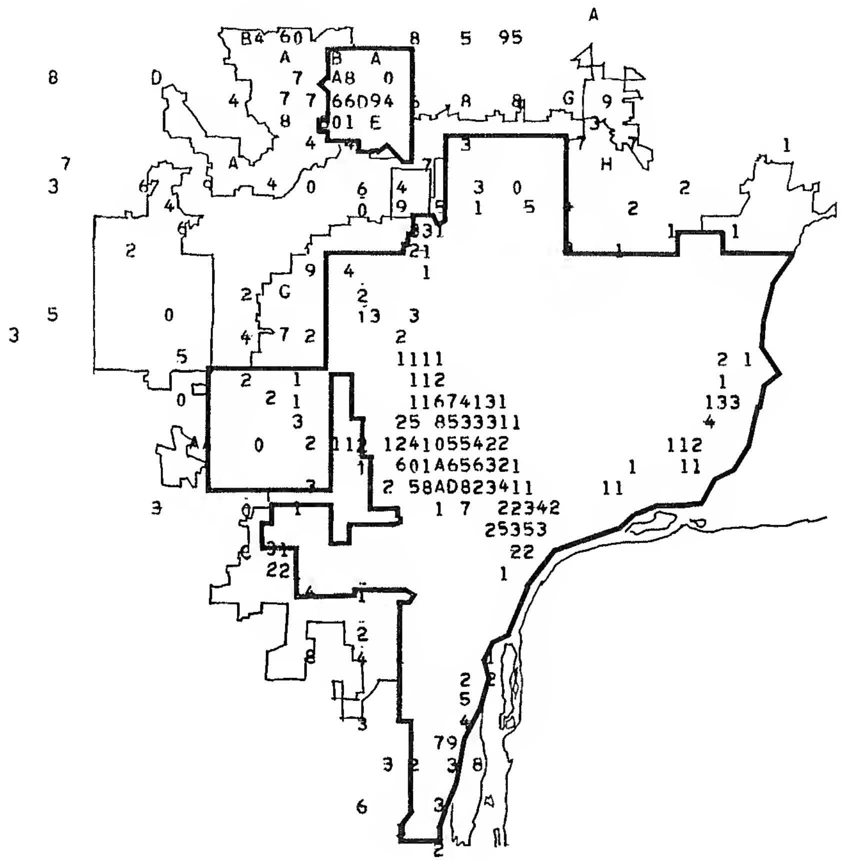
The final map shown is for 15 weapons, each a 5-MT ground burst aimed at the Detroit area. In this computer run, three of the 15 weapons fail to arrive. Nearly one-quarter of the population survive and the "islands" caused by failed weapons are quite evident. Of course, more or fewer missiles could have failed and those that failed could have been others in the group.

The important points for the planner are: (1) many targeted weapons will not arrive; (2) even fallout shelter may be useful in cities; and (3) very large attacks leave survivors in need of emergency aid. As was noted in Panel 10, many of these survivors are injured and at risk from fire and fallout.

One final point. The vulnerability of the population in these examples was assessed as if they were in the aboveground parts of buildings.

If they had been sheltered in the basements of large buildings, about 45 percent of the urban population would have survived the blast effects of a 15-weapon attack. The basis for this statement is discussed in Chapter 2.

SURVIVORS FROM SAMPLE MONTE CARLO RUN FOR FIFTEEN 5 MT ON DETROIT – 22.4% SURVIVORS



PANEL 12

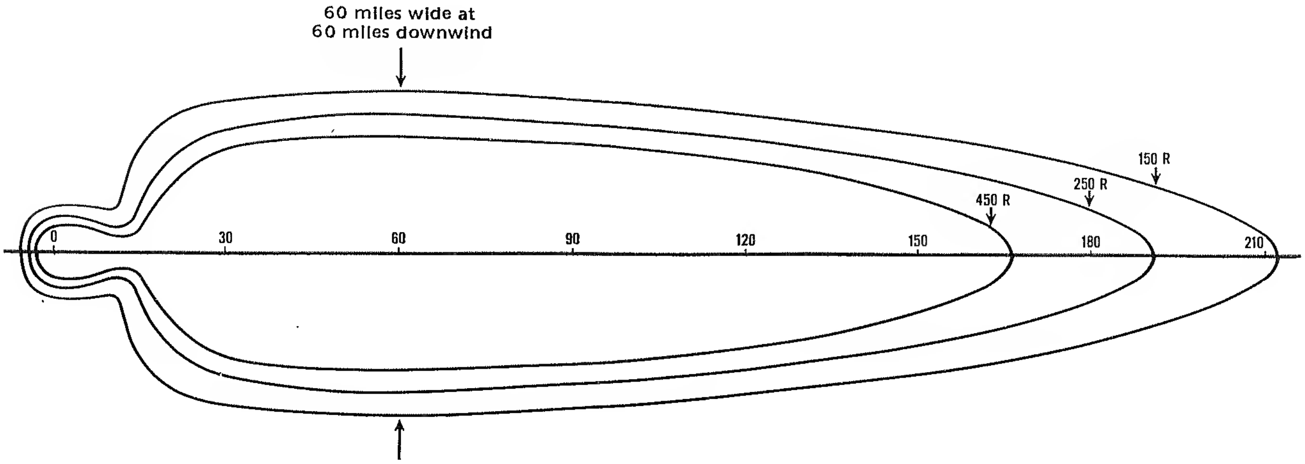
FALLOUT FROM A 5-MT SURFACE BURST

The upper figure shows the general extent of the fallout hazard generated by a single 5-MT surface burst (assuming wind speed of 15 miles per hour blowing toward the right). The contours shown represent the one-week dose to unprotected persons. See Chapter 6 for information on the effect of wind on fallout areas.

The table at the bottom shows the latest information on the consequences of radiation exposure. To illustrate the meaning of the table, people receiving no more than a total of 150 Roentgens, as measured by a dosimeter, during a period of one week or less (1 hour, 1 day, 3 days, for instance) are not expected to need medical care nor to become ineffective in work performance. Accrual of 250 Roentgens would cause some radiation sickness and reduction in work performance. A dose of 350 Roentgens over a period less than one month would have a similar outcome.

Note that one-week doses in the open above 150R may extend over 200 miles downwind of ground zero. Overlapping fallout from several weapons would extend the hazard area much farther.

UNSHIELDED ONE WEEK RADIATION DOSE CONTOURS (SCHEMATIC)



- The expected results of various radiation exposure doses, if received over various periods of time, are shown in the following table.

Acute Effects \ Total Exposure in Roentgens in Any	1 Week	1 Month	4 Months
Medical Care Not Needed	150	200	300
Some Need Medical Care Few if Any Deaths	250	350	500
Most Need Medical Care 50% + Deaths	450	600	*

*Little or no practical consideration.

SIGNIFICANCE OF THE THREAT

If the Soviet Union were to mount an all-out attack on the United States with their present strategic forces, taking into account accuracy, reliability, and other factors, almost the whole population would be located less than 100 miles of at least one nuclear detonation. About half the population would be in areas experiencing at least light damage (overpressure greater than 1 psi). An approximate picture of the probable location of people to weapons aimed against military and industrial facilities can be gained from the table opposite.

The significance for emergency operations planning is:

(1) Virtually every person is within range of potentially serious fallout radiation exposure. All localities need plans for this contingency.

(2) About half the population would be involved in direct weapons effects. Localities near important military and industrial facilities need plans for this contingency as well.

DISTANCE FROM NEAREST WEAPON

(Military-Industrial Attacks)

Distance (miles)	Fraction of Population (percent)
10	45
20	65
40	75
100	95
200	99

WHAT IS A CONTINGENCY?

It is not possible to be sure in advance that any hazardous conditions will or will not occur at any given place. It is necessary to develop civil defense readiness for the major contingencies or attack environments that could reasonably occur.

As the result of enemy attack, a community could find itself in any of the four conditions shown in the figure:

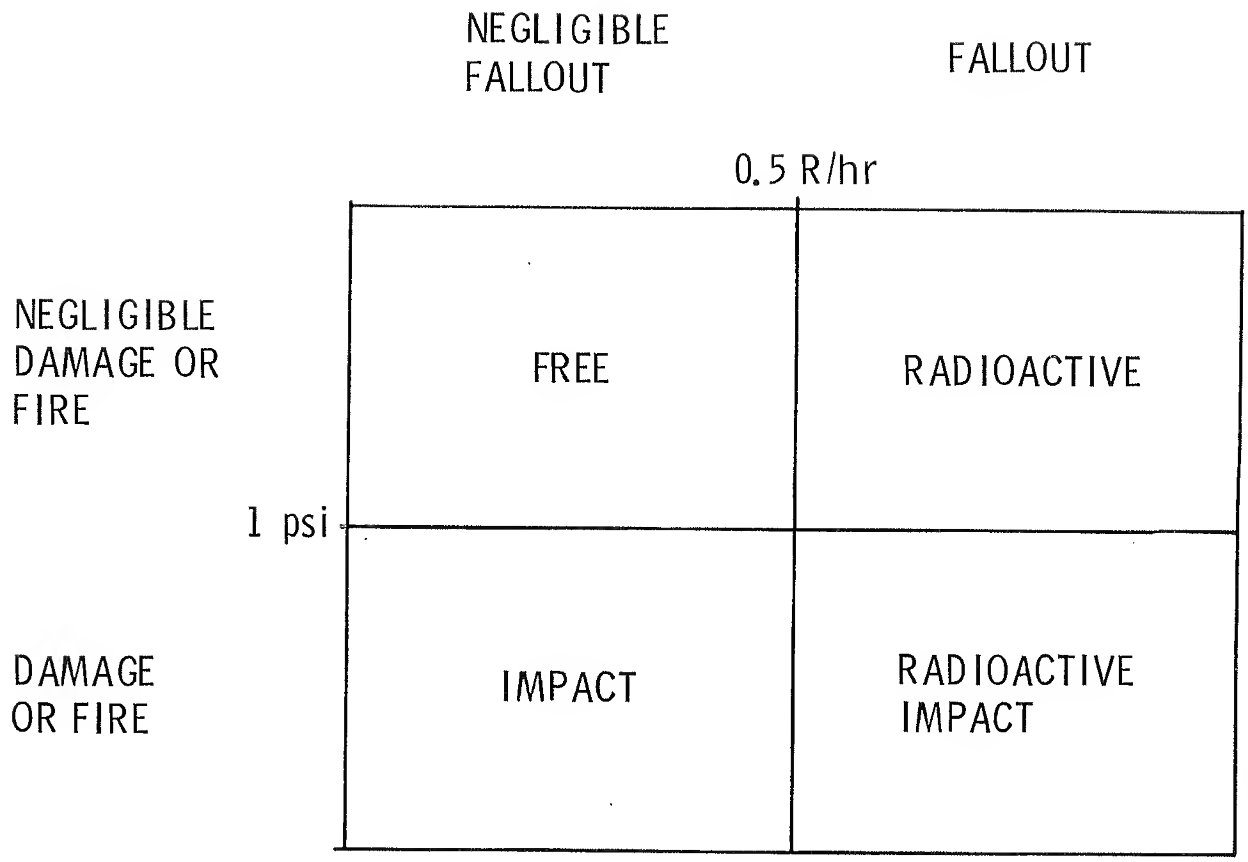
- Free or undamaged areas would be those not affected at all or affected only by fallout radiation of such limited intensity that the dose rate never exceeds 0.5 Roentgens per hour. (Exceeding this dose rate is the standard definition of fallout arrival.) Movement in free areas would not be restricted nor would protective measures be required. But, as we have seen, communities in free areas would generally be within a hundred miles or so of damaged areas and generally much closer. The effectiveness of civil defense operations in saving lives and property could well depend on the carrying out of plans for aid to stricken areas.

- "Radioactive" areas would be affected by fallout only but to such a degree that the dose rate exceeded 0.5 R/hr. Depending on the peak level of fallout radiation that occurs, the fallout radiation hazard could represent a minor impediment to emergency operations or could make any outside operations very hazardous.

- "Impact" areas are those affected by blast damage caused by overpressures in excess of 1 psi or by both damage and ignited fires, but not affected by fallout radiation exceeding a dose rate of 0.5 R/hr. This could occur as the result of air burst weapons or in crosswind and upwind parts of the area of damage from a surface burst.

- "Radioactive-impact" areas would be affected by both damage from blast and fire and fallout radiation in excess of a dose rate of 0.5 R/hr. Emergency operations in such areas would be the most complex and difficult.

These conditions, which are combinations of the presence or absence of direct weapons effects (blast, fire, and initial radiation) and fallout, are the main attack environments for which contingency plans are needed. These plans are "contingency plans" because it will not be known until an attack occurs which of the plans will be needed.


NEGLIGIBLE FALLOUT
FALLOUT
0.5 R/hr
NEGLIGIBLE DAMAGE OR FIRE
FREE
RADIOACTIVE
1 psi
DAMAGE OR FIRE
IMPACT
RADIOACTIVE IMPACT

EMERGENCY OPERATIONS

Most people have a general idea of the kinds of actions likely to be needed in an emergency. A list of emergency functions is shown, together with an explanatory statement of the purpose of each.

Many of these emergency functions are needed in peacetime and most have been required in various natural disasters. This peacetime familiarity and experience can be a trap for the unwary planner who is unfamiliar with the nuclear attack environment described in this handbook. The common practice of assigning responsibility for emergency functions to local departments and agencies whose peacetime functions are similar, although entirely reasonable, often compounds the operational readiness problem because operating officials tend to assume that their usual methods and procedures will be effective.

A useful definition of an "emergency" is a situation in which the routine ways of coping with problems no longer work. If this were not true, a good deal of the need for "emergency readiness" would vanish.

As an example, consider the function of fire fighting. Accidental fires and arson are everyday threats in peacetime. Professional fire departments, both paid and volunteer, are organized, trained, and equipped to deal with the peacetime fire threat. But, as we have already seen, the wartime fire threat will exist almost entirely in areas of damage where debris may litter the streets, water pressure may be lost, and fire trucks may be trapped in the station house. Even if this were not so, the number of simultaneous building fires in an area serviced by a single fire company could number in the hundreds—far beyond the capability of the professional forces. Just as World War II fire fighters had to rely on stirrup-pump and sand-bucket, every ablebodied man must be a fireman in nuclear attack. More important, the real pay-off in fire defense lies in preventing as many ignitions as possible before the attack occurs. That is why the fire fighting mission is stated as it is. The professionals of the fire department must rise to be the builders, leaders, and controllers of this "emergency fire fighting" capability.

The information needed to develop a real operational readiness to combat fire is contained in Chapter 3. But almost none of the other functions listed can be carried out effectively without use of the information in some part of this handbook.

OPERATING SYSTEM FUNCTIONS

FUNCTION	MISSION
1. Sheltering	To shield against weapon and attack effects and to provide a viable environment for shelter occupants
2. Warning	To alert people and to inform them so that a prudent man will act so as to bring himself into the system as intended.
3. Moving	To move people to where the system can protect or support them and back home when displacement is no longer needed.
4. Rescuing	To assist people to move from a hazardous place to one of lesser hazard.
5. Maintaining Health	To minimize the spread of disease.
6. Fire Fighting	To minimize personal injury and property damage by reducing thermal flux, probability of ignition, and burning rate and by suppressing fires.
7. Maintaining Law and Order	To protect people and property against illegal acts and to improve system effectiveness by maintaining order.
8. Protecting Livestock	To minimize damage to, and denial of the product of, livestock.
9. Emergency Shutdown	To reduce damage to property caused (1) by leaving it unattended or (2) by not leaving it in its best posture to sustain attack effects.
10. Medical Care	To minimize death and disability from illness and injury and to care for those displaced because of the threat or the effects of attack.
11. Feeding	To provide food and water to those displaced by attack or threat of attack or to whom normal supply channels are closed.
12. Housing	To provide temporary lodging to people displaced in a strategic or remedial movement.
13. Restoring Facilities	To repair or replace utilities and facilities vital to the survival of the people and the functioning of the system.
14. Decontaminating	To minimize denial of access and radiation damage by removing contaminating radioactive materials.
15. Welfare Services	To provide material aid and counsel for people displaced by attack or threat of attack.

*From Devaney, J.F., **The Use of Systems Techniques in Civil Defense**, URS Research Co., May 1970.

OPERATIONS IN VARIOUS CONTINGENCIES

Not all emergency functions will be needed in every contingency. Indeed, one might conclude that no emergency functions would be required at all where the community found itself free of weapon effects following an enemy attack. The table shown here indicates that such is not the case. Widespread loss of electric power because of attack effects elsewhere and the disruption of normal supply channels could precipitate health and feeding problems. The normal livelihood of many individuals would have been jeopardized. Refugees from stricken areas, many injured, may need care. And, in any event, the population must be sheltered until it becomes clear that the local area will remain free of attack effects. Thus, a plan for the free contingency is needed.

Although the table indicates the general applicability of emergency measures in the various contingencies, it leaves important issues unresolved. Sheltering and many other functions are of a different character in radioactive areas than they are in impact areas. Fire fighting in impact areas where fallout is also present presents problems not encountered in impact areas without fallout. (Accidental fires can occur outside impact areas, but these can be dealt with more or less routinely, as in peacetime.) And what if fires rage out of control, despite the best efforts of the defenders?

Questions like these suggest that what is needed for emergency operational planning is an indication of the relative priorities among the various emergency functions and the ways they should be grouped into coordinated activities.

OPERATIONS IN CONTINGENCIES

Function	Contingencies: Free	Impact	Radioactive	Radioactive-Impact
1. Sheltering	*	Yes	Yes	Yes
2. Warning	*	Yes	Yes	Yes
3. Moving	No	Yes	Yes	Yes
4. Rescuing	No	Yes	No	Yes
5. Maintaining Health	Yes	Yes	Yes	Yes
6. Fire Fighting	No	Yes	No	Yes
7. Maintaining Law and Order	Yes	Yes	Yes	Yes
8. Protecting Livestock	*	No	Yes	No
9. Emergency Shutting Down	*	Yes	Yes	Yes
10. Medical Care	**	Yes	Yes	Yes
11. Feeding	Yes	Yes	Yes	Yes
12. Housing	**	Yes	Yes	Yes
13. Restoring Facilities	No	Yes	No	Yes
14. Decontaminating	No	No	Yes	Yes
15. Welfare Services	**	Yes	Yes	Yes

*At least until threat of attack is over.
**At least for evacuees from affected areas.

TWO BASIC FIRE SITUATIONS

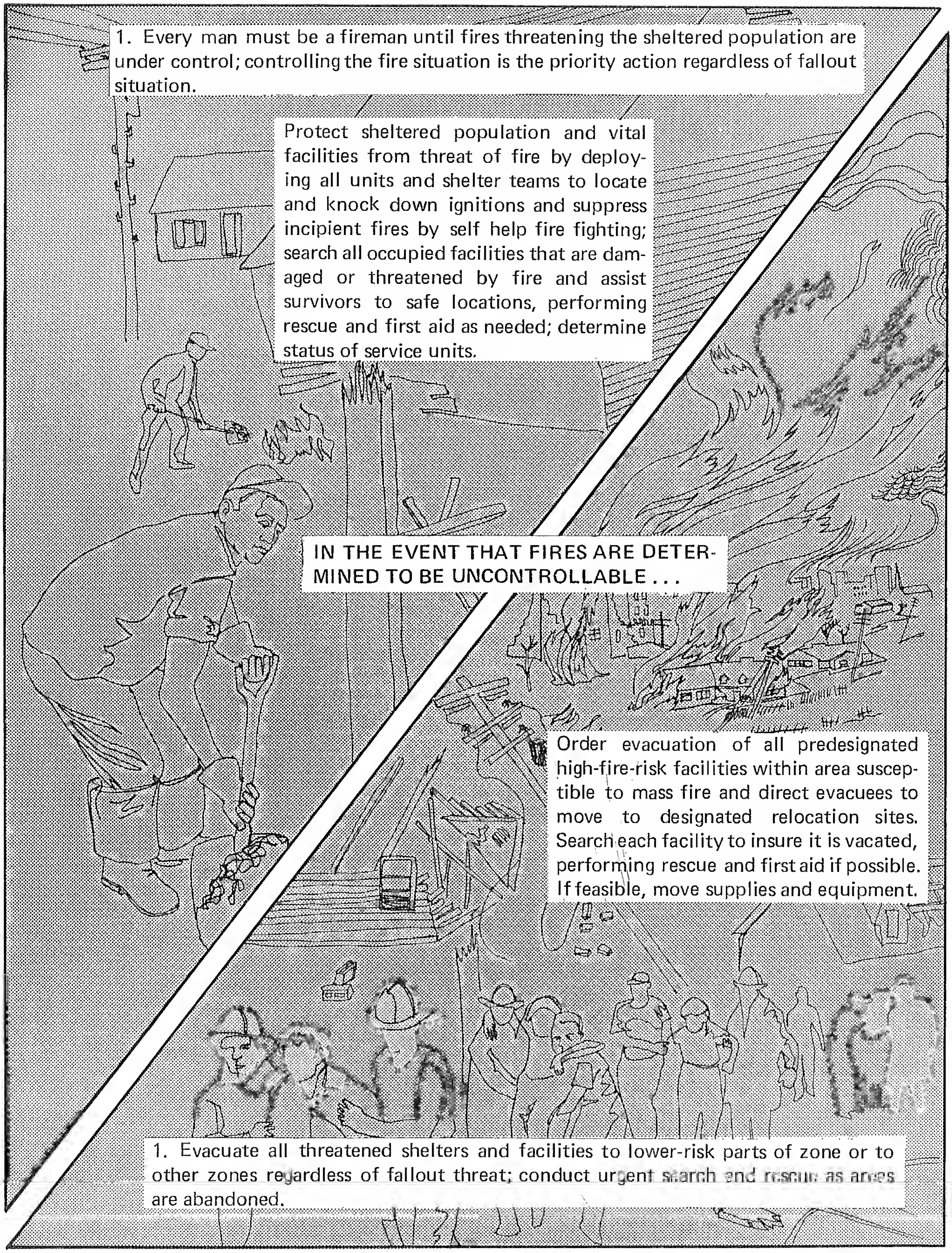
As we have seen, sheltering is the basic measure that shields the population against weapon effects, both direct effects and fallout. This is true whether special-purpose shelters are constructed, best available space in existing structures is used, or people are evacuated from cities to the hinterland where "expedient" protection is sought.

In impact areas and radioactive-impact areas, the basic goal of emergency operations must be to preserve the population in their sheltered condition. Fire developing from ignitions caused by the blast and thermal pulse will be the major continuing threat to the sheltered population. Therefore, emergency operations in these areas will necessarily focus on and be determined by the emerging fire threat.

As will be seen in Chapter 3, the ignitions develop slowly into sustained fires, partly because the blast wave tends to reduce them to a smouldering condition. Prompt action to control ignitions in their early stages can be quite effective. For a period ranging up to an hour or more, all ignitions are potentially controllable. During the "controllable fire" situation, all efforts must be directed toward fire suppression, and other emergency actions would be taken only for the purpose of contributing to the fire control effort.

If emergency fire fighting is successful, the incipient fires will be suppressed or contained, with perhaps the loss of only a few buildings. On the other hand, the fire suppression effort may be insufficient and developing fires may get out of hand. Where most survivors are injured or damage and debris prevent prompt action, it may become clear almost at the outset that the developing fires cannot be controlled. In the "uncontrollable fire" situation, the focus of actions would shift from fire suppression to the search, rescue, and movement of the survivors out of the fire area or to refuges where they can survive the ensuing burnover.

These two fire situations—controllable and uncontrollable— are really two different contingencies to be planned for. In other words, two separate plans for two separate sets of coordinated actions will be needed for impact areas.


1. Every man must be a fireman until fires threatening the sheltered population are under control; controlling the fire situation is the priority action regardless of fallout situation.
Protect sheltered population and vital facilities from threat of fire by deploying all units and shelter teams to locate and knock down ignitions and suppress incipient fires by self help fire fighting; search all occupied facilities that are damaged or threatened by fire and assist survivors to safe locations, performing rescue and first aid as needed; determine status of service units.
IN THE EVENT THAT FIRES ARE DETERMINED TO BE UNCONTROLLABLE . . .
Order evacuation of all predesignated high-fire-risk facilities within area susceptible to mass fire and direct evacuees to move to designated relocation sites. Search each facility to insure it is vacated, performing rescue and first aid if possible. If feasible, move supplies and equipment.
1. Evacuate all threatened shelters and facilities to lower-risk parts of zone or to other zones regardless of fallout threat; conduct urgent search and rescue as areas are abandoned.

PANEL 18

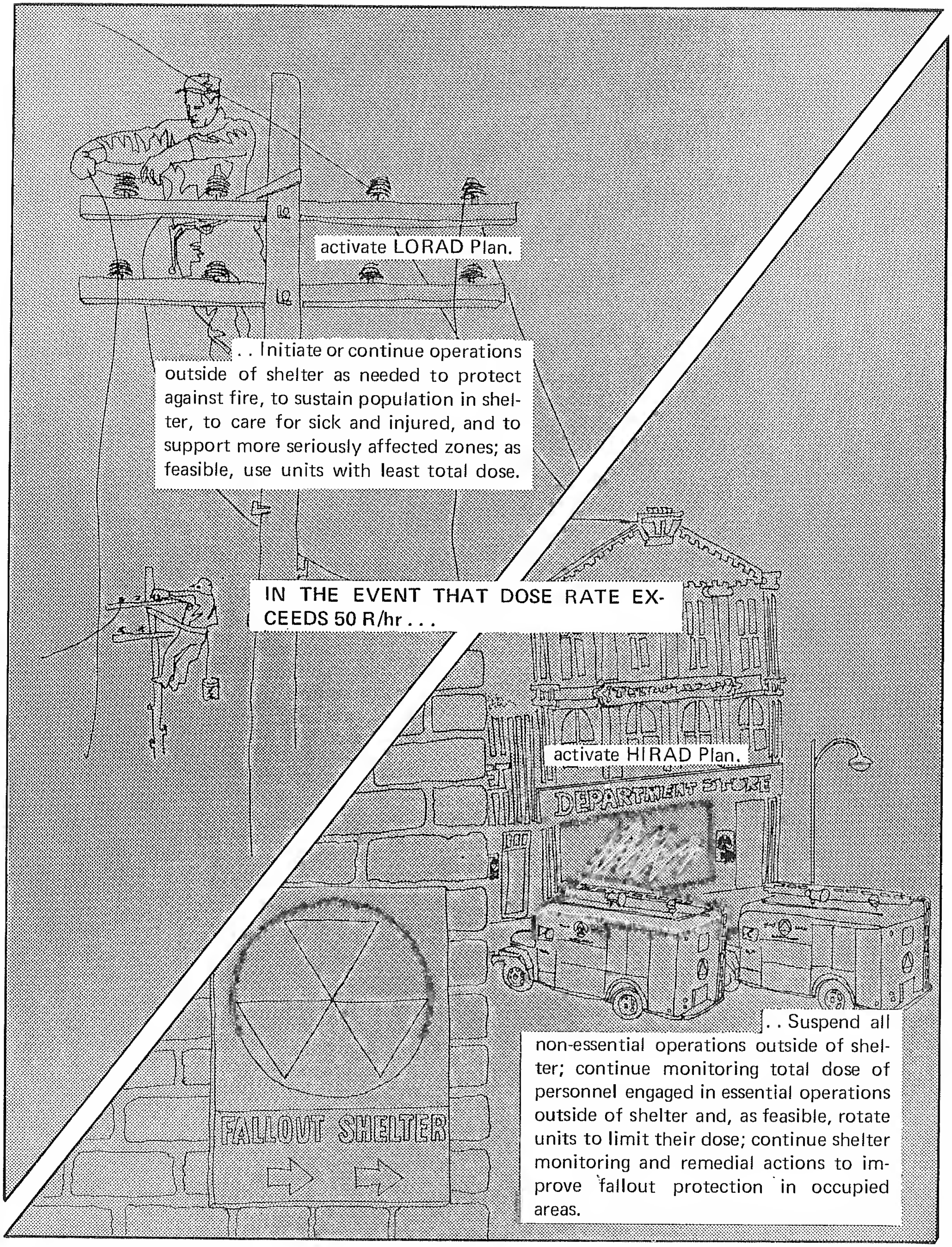
TWO BASIC FALLOUT SITUATIONS

For operational purposes, it is also important to subdivide the radioactive condition into two basic operating situations. Dose rates of a few Roentgens per hour, although above the fallout arrival criterion of 0.5 R/hr, would place only minor restrictions on outside operations. At higher dose rates, less and less time could be devoted to emergency operations without subjecting personnel to doses that could prove disabling. At 50 R/hr, three to four hours of exposure would result in some radiation sickness.

In the high radiation region above 50 R/hr, few outside operations are feasible without risking incapacitating exposure. Only desperate needs, such as protecting the population against fire, would justify emergency operations. Unless a critical need existed, the most appropriate response would be to "pin down" in the best available fallout shelter until radioactive decay results in a less hazardous fallout environment.

Below 50 R/hr, outside operations are generally feasible. Operations should be confined to essential tasks, such as search and rescue, resupply of shelters, and reconstitution of urgent utility services. Exposure of persons conducting such operations can be controlled by rotation of work crews and similar measures. Therefore, the range of appropriate emergency actions is much greater than in the high radiation situation and should be planned for as a separate contingency.

For planning purposes, the measured dose rate of 50 R/hr has been taken as the dividing line between dose-controlled operations in radioactive areas and a virtual "pin down" situation.


activate LORAD Plan.
. . Initiate or continue operations outside of shelter as needed to protect against fire, to sustain population in shelter, to care for sick and injured, and to support more seriously affected zones; as feasible, use units with least total dose.
IN THE EVENT THAT DOSE RATE EXCEEDS 50 R/hr . . .
activate HIRAD Plan.
DEPARTMENT STORE
FALLOUT SHELTER
. . Suspend all non-essential operations outside of shelter; continue monitoring total dose of personnel engaged in essential operations outside of shelter and, as feasible, rotate units to limit their dose; continue shelter monitoring and remedial actions to improve fallout protection in occupied areas.

PANEL 19

BASIC OPERATING SITUATIONS

Based on consideration of the fire and fallout problems, the four conditions of damage should be expanded to the nine Basic Operating Situations shown here. As can be seen, the "Radioactive Area" has been divided into the two fallout situations, "moderate" and "severe." The "Impact Area" has been subdivided into two fire situations, "controllable" and "uncontrollable." The Radioactive-Impact Area has become four basic situations: 5, 6, 8, and 9. The combinations of conditions of fire and fallout are shown in the boxes, where NEG- means negligible, LO means moderate or controllable, and HI means severe or uncontrollable.

In general, these Basic Operating Situations (BOS) form an adequate basis for the preparation of contingency plans for emergency operations under nuclear attack conditions. It is the purpose of this handbook to give the planner some insight into the nature of the attack environment that would be encountered in each of these situations and the implications of the attack environment for emergency operations planning.

Each BOS (pronounced "bahss") can be identified by readily observable characteristics of the attack environment. In an actual attack, rapid assessment of the BOS and automatic response through planned actions will be essential if timely operations to save lives are to be carried out.

It will be noted that the numbering of the Basic Operating Situations corresponds approximately to the severity of the situation. If more than one BOS were to exist within the community at the same time, the contingency plan appropriate to the most severe situation (highest numbered BOS) should be used. BOS numbers will also be found highly useful as a brevity code for communicating a situation report.

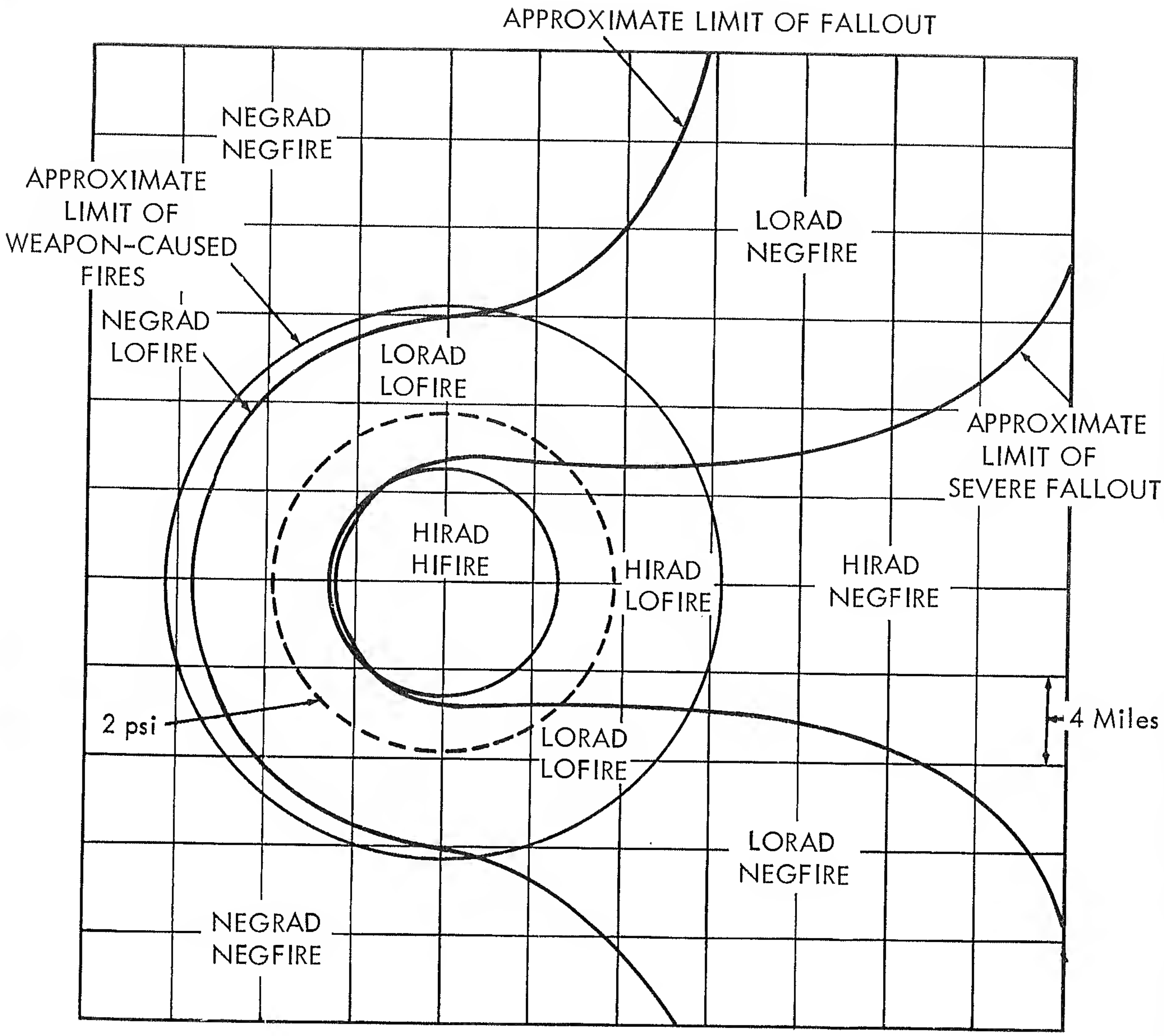
	NEGLIGIBLE FALLOUT	MODERATE FALLOUT	SEVERE FALLOUT
	0.5 R/hr	50 R/hr	
NEGLIGIBLE DAMAGE OR FIRE	1 NEGRAD NEGFIRE	2 LORAD NEGFIRE	3 HIRAD NEGFIRE
1 psi			
DAMAGE OR CONTROLLABLE FIRE	4 NEGRAD LOFIRE	5 LORAD LOFIRE	6 HIRAD LOFIRE
UNCONTROLLABLE FIRE	7 NEGRAD HIFIRE	8 LORAD HIFIRE	9 HIRAD HIFIRE

Basic Operating Situations

APPLICATION TO A 5-MT SURFACE BURST

A first approximation of the relationships among the nine Basic Operating Situations can be seen in this illustration of the close-in area around a single 5-MT surface burst. The most severe BOS is shown in the various parts of the area and related to a grid 4 miles on a side.

The fallout pattern is representative for a wind speed of about 15 miles per hour. (See Chapter 6 for a discussion of the effect of wind speed.) The assumptions defining the fire area are more complex. The LOFIRE area is assumed to be defined by the area having a blast overpressure of at least 1 psi, which encompasses the region of significant damage to buildings, especially single-family residences. The range of initial fires on a clear day, however, is likely to be limited to about the 2-psi line, which is shown as a dotted circle. As will be discussed in Chapter 3, the region of uncontrollable fire (HIFIRE) is related more to the built-upness of the urban area and the fire defense actions taken than it is to the distance from Ground Zero. For illustrative purposes, we have assumed that the HIFIRE circle encompasses the area having an overpressure of at least 4 psi. The actual fire situation is likely to be much less uniform than that shown here. The circumstances under which uncontrollable fires may occur are described in Chapter 3.



CLOSE-IN EFFECTS OF 5-MT SURFACE BURST
(15 mph wind speed)

APPLICATION TO A MILITARY-INDUSTRIAL ATTACK

A better appreciation of the significance of the nine Basic Operating Situations for planning can be gained by considering the location of blast survivors after a large attack against military and industrial targets in the U.S. The delivered megatonnage in this hypothetical attack is 4700, with weapon yields ranging from 1MT to 25 MT.

About 17 percent of the preattack population (about 35 million people) are judged to have been killed outright in the direct effects area. The percentage figures in the diagram indicate the proportion of survivors experiencing at most the BOS shown.

Note that 70 percent of the survivors are outside the direct effects area (a BOS of 3 or less). Most of these people (nearly 90 percent) are in fallout areas; the majority in a severe fallout area. The safety of more than half the survivors would depend on how well communities are prepared with community shelter plans and the emergency operations plans to make the best available fallout shelter work.

Almost all of the survivors in the direct effects area (BOS 4 and higher) will also experience fallout. Preserving the fallout shelter of these people would be of prime importance. The assumptions on fire in this case are the same as in the previous chart. Under the assumption of uncontrollable fire above 4 psi blast overpressure, most of the blast survivors would be in an uncontrollable fire situation and would need to be moved to safer areas. A major implication for emergency planning is that the continued survival of over 60 million survivors would depend on how well prepared the urban communities were to control the fires in the damaged areas.

BASIC OPERATING SITUATIONS FOR BLAST SURVIVORS OF A MILITARY-INDUSTRIAL ATTACK

0.5 R/hr — 50 R/hr

	NEGLIGIBLE FALLOUT	MODERATE FALLOUT	SEVERE FALLOUT	
NEGLIGIBLE DAMAGE OR FIRE	1 8%	2 16%	3 46%	70%
1 psi				
DAMAGE OR CONTROLLABLE FIRE	4 (Very Small)	5 1%	6 8%	9%
UNCONTROLLABLE FIRE	7 Negligible	8 4%	9 17%	21%
	8%	21%	71%	

The survivors of this 4700-MT attack against military and industrial objectives constitute 83 percent of the preattack population, 17 percent having been killed immediately by the blast effect.

ANOTHER USEFUL APPROACH TO PLANNING

We have seen that, in a large attack, almost the whole population will find itself within 100 miles of at least one nuclear detonation. This suggests that emergency aid to the communities in the damaged areas could save many lives. The previous example indicated that about 70 percent of the immediate survivors would be free of direct effects. This majority of survivors constitutes a great potential for mutual aid, either immediately or as soon as the severe fallout hazard subsides.

If we define a "nearby burst" as one sufficiently near for the blast wave to break windows (about 0.1 to 0.2 psi), most of the population that was "free of direct effects" would be nearby. Communities in this situation should be prepared to render "close support" to those in the direct effects area. Communities beyond the region of glass breakage should be prepared to render "back-up support" if requested.

Planners who are familiar with the format of the Checklist Guide for Nuclear Emergency Operations Planning (also called ALFA NEOP—being published as CPG 2-2A) will recognize that the plan sections in the checklist follow this approach.

Plan B covers Back-up support to distant burst areas.

Plan C covers Close support to nearby areas.

Plan D covers Damage control in the direct effects area.

Plan E covers Evacuation of shelters at risk from uncontrollable fire.

Plan A, of course, is the preattack increased readiness plan.

With respect to mutual aid, this will be found to be a useful approach to contingency planning.

FREE OF DIRECT EFFECTS	DISTANT BURSTS	B ackup Support
	NEARBY BURSTS	C lose Support
DIRECT EFFECTS	CONTROLLABLE FIRE	D amage Control
	UNCONTROLLABLE FIRE	E vacuation of Area

PANEL 23

THE NEED FOR DIRECTION AND CONTROL

The general nature of civil defense operations under nuclear attack conditions that has been presented in this Chapter should indicate the need for effective direction and control of emergency operations. Time is of the essence in emergency operations. Measures tardily taken will probably be ineffective. The Basic Operating Situation must be assessed quickly so that coordinated actions can be carried out expeditiously. Local organization and training must reflect the reality of the probable contingencies.

Direction and control functions, which span those shown here, are best centered in an Emergency Operations Center (EOC) where the decision-makers can be provided with all of the relevant information on attack effects and the condition of emergency forces and the population. Operations in radioactive areas, for example, require information on fallout conditions that can only be obtained by special monitoring equipment, the use of which is discussed in Chapter 6. This RADEF capability is an essential part of direction and control.

Because nuclear weapons effects cover large areas and are no respector of jurisdictional boundaries, a hierarchy of EOCs is needed. No community can afford to plan to "go it alone" as if the war stopped at the city limits. In many instances, mutual aid will make the difference of life or death for large numbers of people.

Similarly, each community will need subordinate direction and control nodes for the operating services and the sheltered population. In subsequent chapters, the planner will be reminded of the usefulness of staging areas and shelter complex headquarters in the carrying out of emergency operations.

DIRECTION AND CONTROL*

CONTROL	MISSION
1. Organizing	To control the employment of available staff, facilities, equipment, and supplies so as to maximize system readiness to use its remaining capability in the real emergency environment.
2. Planning	To define the problems existing in the situation and to inform the executive as to the courses of action available to him and the probable results and risks expected for each.
3. Informing	To acquire data, process them into the required form, store and retrieve them, and communicate them to the person who needs them when he needs them.
4. Deciding	To judge the relative worth and desirability of alternative courses of action and to select the course to be taken.
5. Commanding	To require that a selected course of action be taken and to review the effects of taking it.

*From Devaney, J. F., The Use of Systems Techniques in Civil Defense, URS Research Company, May 1970.

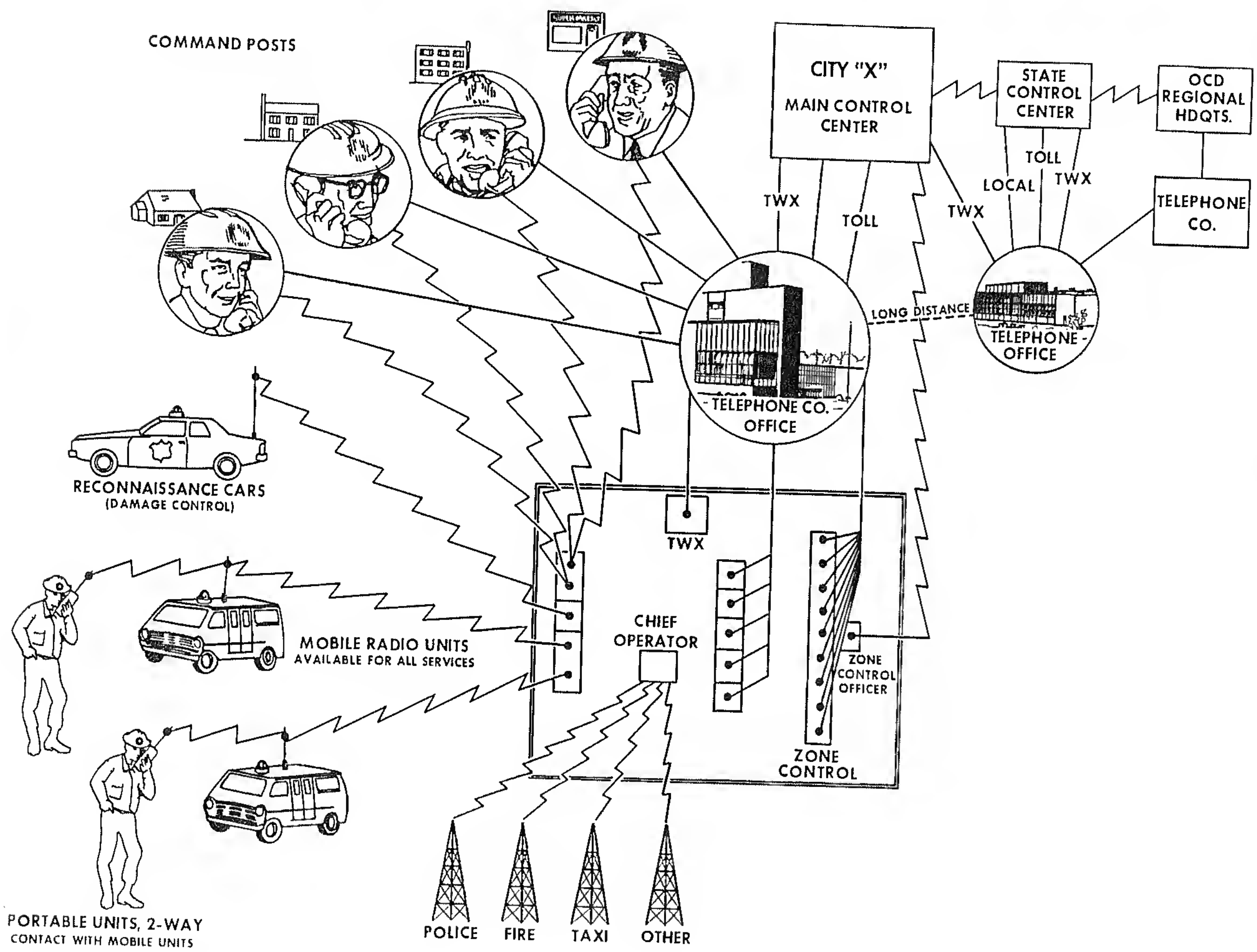
THE IMPORTANCE OF COMMUNICATIONS

Organized and coordinated emergency actions require communication of essential information throughout the civil defense operating system. Public safety in peacetime depends on police, fire, and public works communication nets. The disruptive effects of natural disasters on communications have often been a major impediment to effective emergency operations. The nuclear attack environment will place additional strains on communication capabilities. Some of the threat to continued communication, such as the electromagnetic pulse (EMP), are peculiar to nuclear attack and not well understood by most people. These problems and the practical ways to deal with them will be outlined in appropriate parts of this manual.

Some essential parts of the civil defense operating system do not have well-developed emergency communications. Notable examples are the medical services and the shelter system. Planners must pay particular attention to improving operational readiness in these areas.

Despite the best efforts of all concerned, communications outages must be expected under nuclear attack conditions. Plans must be laid to permit operations to "degrade gracefully" in the face of communications difficulties. Through training and exercises, the basic concepts of emergency operations must be instilled at all levels of operation so that direction and control can become decentralized as necessary to meet the situation. If this is not done, communications losses can lead to catastrophic failure of organized action.

COMBINED WIRE AND RADIO COMMUNICATIONS



CONCEPT OF OPERATIONS

All of the foregoing leads to the general concept of operations summarized here.

The challenge of realistic emergency operations planning is to translate these precepts into specific arrangements that will organize all local capabilities and resources to carry out the civil defense mission within the particular community and the surrounding region. The general actions needed are enumerated in planning guidance and emergency action checklists. They are further discussed in the following chapters.

Until the planner explores each necessary action to the point where specific assignments can be made, the foundation for operational readiness will not be laid. Realistic plans will define exactly who will carry out what tasks and with what resources in response to events precipitated by the attack. This will require a firm understanding of the operating conditions under which each action must be carried out.

SUGGESTED ADDITIONAL READING

The following sources provide additional background on the material in this chapter:

Effects of Nuclear Weapons, Revised Edition 1964, Glasstone, S. (editor), Superintendent of Documents, GPO.

DCPA **Local Emergency Action Check List (Field Test Edition)**, FG G-1.2/2, June 1971.

Devaney, J.F., **The Use of Systems Techniques in Civil Defense**, URS Research Co., May 1970.

National Security Strategy of Realistic Deterrence, Annual Defense Department Report for FY 1973, February 1972.

Background of Civil Defense and Current Damage Limiting Studies, OCD, TR-35, June 1966.

Schmidt, L.A., **A Sensitivity Analysis of Urban Blast Fatality Calculations**, Institute for Defense Analyses, January 1971.

Rainey, Charles T., **Nuclear Emergency Operations Planning at the Operating Zone Level**, Stanford Research Institute, October 1970.

Harker, Robert A., **Evaluation of Emergency Operations Simulation Training**, URS Research Co., November 1970.

NOW THAT WE'RE ORGANIZED
WHAT THE HECK ARE WE SUPPOSED TO DO?

PANEL 27